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REVIEW ARTICLE

Ten Steps to Improve Sepsis Care in Low-Resource Settings

OBJECTIVES: To develop a practical consensus-based framework for ten steps to improve sepsis care in low-resource settings (LRSs), aligned with the sepsis chain of survival and informed by global expertise.

DATA SOURCES: We reviewed peer-reviewed literature on sepsis epidemiology, prevention, recognition, and management in LRS; international guidelines, including the Surviving Sepsis Campaign; and prior "ten-step" consensus frameworks for resuscitation and emergency care.

STUDY SELECTION: A Task Force representing adult and pediatric sepsis care, emergency care, critical care, infectious diseases, public health, and implementation science identified key domains from the above data sources.

DATA EXTRACTION: With guidance from methodologists and implementation science experts, we employed an iterative, consensus-based process—literature review, Delphi survey, Utstein-style conference, stakeholder input, and public comment—to first define and then refine steps and implementation strategies.

DATA SYNTHESIS: The process resulted in ten nonsequential, actionable steps covering governance and commodities, provider and caregiver education, community and facility prevention, early recognition and rapid response, timely guideline-based interventions, structured post-sepsis care, data systems, quality improvement, a culture of excellence and respect, and holistic well-being of patients, caregivers, and providers. Each step includes a rationale and potential implementation strategies adaptable to local resources and needs. Collectively, the ten steps emphasize integration across the continuum of care, equitable access to essential interventions, and the role of emerging technologies to prevent, recognize, monitor, and follow-up sepsis.

CONCLUSIONS: The ten steps provide a consensus-driven roadmap for health leaders, clinicians, and policymakers to improve sepsis care, strengthen the sepsis chain of survival, reduce preventable morbidity and mortality, and address global inequities in sepsis outcomes.

KEYWORDS: emergency care frameworks; international collaboration; low-income countries; low-resource settings; public health policy; sepsis management

Teresa B. Kortz, MD, MS, PhD[1,2]
Jorge L. Hidalgo, MD, MACP, MCCM, FCCP[3]
Samuel O. Akech, MBChB, MMed, PhD[4]
Sheila N. Myatra, MD, FCCM, FICCM[5]
Ryan C. Maves, MD, FCCM[6]
Javier Perez-Fernandez, MD, FCCM[7]
Subhash P. Acharya, MD, FACC[8]
Craig M. Coopersmith, MD, MCCM[9]
Shevin T. Jacob, MD, MPH[10,11]
Cintia Johnston, PhD[12]
Niranjan Kissoon, MBBS, MCCM, FRCP(C), FACPE[13]
Flávia R. Machado, MD, PhD[14]
Elizabeth Molyneux, MBBS, FRCP, FRCPCH, FCEM, DSc h.c., OBE[15]
Brenda M. Morrow, PhD[16]
Martha Susana Pérez Cornejo, MD, FCCM[17]
Chairat Permpikul, MD[18]
Kunchit Piyavechviratana, MD[19]
Andrew Rhodes, MBBS, MD(Res), FRCA, FFICM, FRCP[20]
Mpoki M. Ulisubisya, MD, MMed, FCA(ECSA)[21]
Vishakha K. Kumar, MD, MBA[22]
Hariyali Patel, MHA[22]
Daniel Woznica, PhD[22]
Vinay M. Nadkarni, MD, MS, FCCM[23]

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Sepsis is a dysregulated immune response to infection that can induce life-threatening organ dysfunction (1). Sepsis accounts for one in five deaths worldwide, with an estimated 49 million cases annually (2), and 85% of both sepsis cases and deaths occur in low-resource settings (LRSs) (2). Integrated management across the sepsis Chain of Survival (3) (**Fig. 1**) is therefore essential: awareness and prevention; early recognition and call for help; continuous source control; appropriate fluids, oxygen, and antibiotics; critical care without walls; and post-sepsis care.

Building on successful ten-step frameworks for high-quality resuscitation for out-of-hospital (4) and in-facility adult (5), pediatric (6), and neonatal

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SHOUT
SHARE
IT

KEY POINTS

Question: Can a consensus-based framework be developed that provides practical, actionable guidance to improve sepsis care across the continuum of care in low-resource settings?

Findings: An international, multidisciplinary Task Force used a rigorous consensus process to develop ten nonsequential, adaptable steps addressing governance, education, prevention, early recognition, timely guideline-based management, post-sepsis care, data systems, quality improvement, and workforce and patient well-being.

Meaning: This framework offers a pragmatic roadmap for clinicians, health system leaders, and policymakers to strengthen the sepsis chain of survival, improve quality of care, and reduce preventable sepsis morbidity and mortality in low-resource settings.

cardiac arrest (7), the Utstein Formula for Survival (8)—Medical Science, Educational Efficiency, and Local Implementation (9)—has been adapted to sepsis. However, this step-by-step approach to implement the Surviving Sepsis Campaign guidelines (10) was not specifically applicable to LRS. In response, the Society of Critical Care Medicine (SCCM) convened a global Task Force to develop consensus guidance that reflects current evidence, leverages international expertise, and promotes optimal care worldwide.

The ten steps aim to improve recognition, timely response, local implementation, quality of care, and outcomes across the Chain of Survival (3), particularly in LRS. They apply to communities, emergency responders, healthcare facilities, and systems, helping to identify gaps and prioritize interventions according to local needs. "The steps are neither sequential nor prescriptive but are adaptable to context." Central to the ten steps is the interdisciplinary team's role to prevent, recognize, manage, and monitor outcomes, while promoting awareness across the continuum of care (**Fig. 2**). Importantly, the ten-step approach aligns with the World Health Organization's (WHO) resolutions on Integrated Emergency, Critical, and Operative Care (11, 12) and the Acute Care Action Network (ACAN) (13). These ten steps were designed to be actionable, synergistic, and applicable across resource-variable settings.

METHODOLOGY

A SCCM committee formed a Task Force of global sepsis leaders, appointed for their clinical, public health, and/or research experience in low-, middle-, and high-resource settings with attention to conflicts of interest (**Supplemental Table 1**, https://links.lww.com/CCM/H916). To guide the discussion and development of the ten steps to improving care in LRS, the Task Force defined sepsis as a "life-threatening organ dysfunction caused by a dysregulated host response to infection" (1) and conceptualized sepsis management along the "Chain of Survival" framework (3) (Fig. 1). Both community- or facility-acquired sepsis require early recognition and time-critical interventions and were, therefore, considered (14).

A four-part, iterative, consensus-based process was used: 1) literature review, 2) Delphi survey, 3) Utstein-style conference (15), and 4) public comment. The methods and findings from the literature review and Delphi survey are detailed in a separate publication. During an 8-month virtual preparatory phase

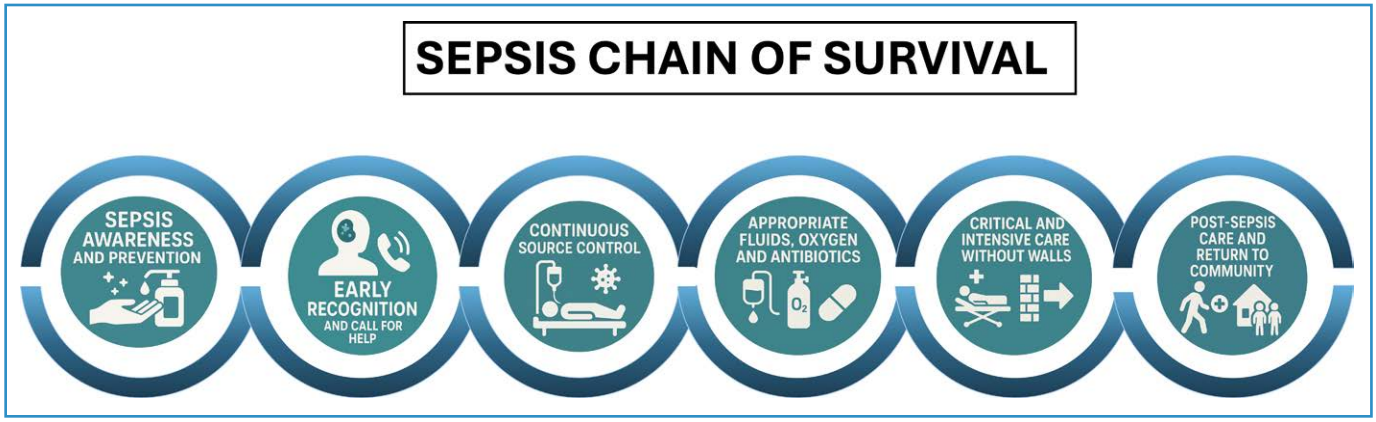
SEPSIS CHAIN OF SURVIVAL
SEPSIS AWARENESS AND PREVENTION
EARLY RECOGNITION AND CALL FOR HELP
CONTINUOUS SOURCE CONTROL
APPROPRIATE FLUIDS, OXYGEN AND ANTIBIOTICS
CRITICAL AND INTENSIVE CARE WITHOUT WALLS
POST-SEPSIS CARE AND RETURN TO COMMUNITY

Figure 1. Sepsis chain of survival.

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(2024), candidate measures were refined using prior ten steps documents as templates (4–7). An in-person Utstein-style meeting (October 13–14, 2024, Vaud, Switzerland) (15) began with a review of literature findings and candidate "steps." Concepts with greater than 80% agreement were advanced. In rotating small groups, members discussed draft steps, with moderators summarizing, refining, aligning, and resolving differences in content across sessions (**Supplemental Fig. 1**, https://links.lww.com/CCM/H916). A plenary session confirmed consensus (> 80% agreement), followed by a second rotation session to identify implementation strategies. The draft ten steps were then shared with the Task Force, SCCM and Surviving Sepsis Campaign leadership, and representatives from WHO and ACAN at the Geneva 2024 meeting to solicit feedback. Afterward, a 14-day public comment period invited feedback from global stakeholders and the public (**Supplemental Tables 2** and **3**, https://links.lww.com/CCM/H916) (7). The SCCM Discovery Council reviewed and approved the ten steps (**Table 1**) before submission. Supporting evidence and additional discussion for the implementation strategies are available in **Appendix 1** (https://links.lww.com/CCM/H916) and a reducing mortality from sepsis in LRS toolkit is available online (sccm.org/sepsis-10-steps).

TEN STEPS TO IMPROVE SEPSIS CARE IN LOW-RESOURCE SETTINGS

PREPARE

Step—Governance, Health Commodities, and Products

Action: Ensure health system readiness to manage sepsis, inclusive of adequate supplies and infrastructure.

Rationale: Effective sepsis care depends on infrastructure, access to essential commodities, and sustained financing; robust governance, national and local leadership, and strategic planning are required to overcome resource constraints (16, 17). Governments and facilities should integrate sepsis care commodities and products into national and facility essential medicine lists and procurement plans, use incentives to reduce costs, and implement long-term budgets covering equipment, personnel, and infrastructure. Supply chain and inventory management tools, contracts with reliable suppliers and local distributors, and direct engagement with manufacturers can reduce stockouts,

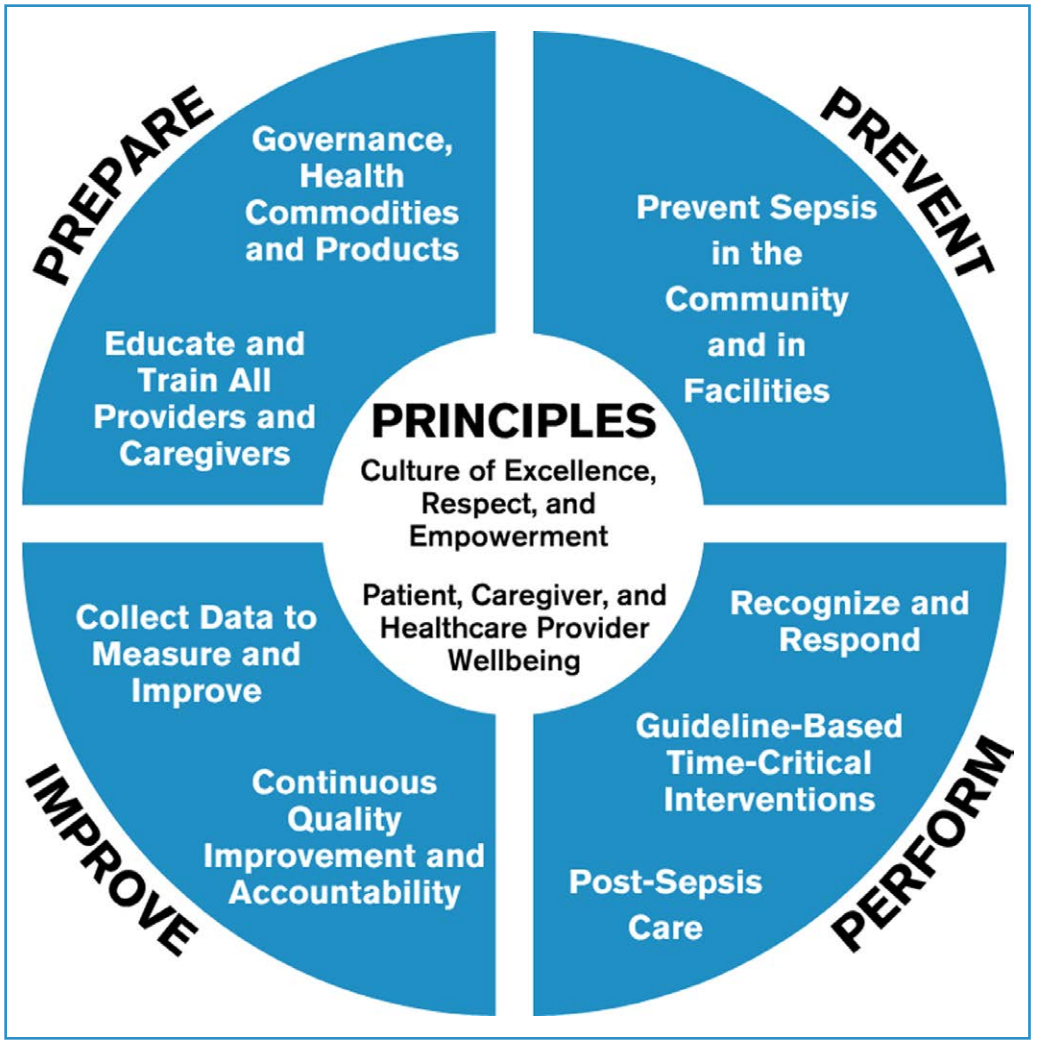

Figure 2. The ten steps toward improving sepsis quality of care and outcomes in low-resource settings as a cycle of continuous improvement.

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TABLE 1.
Summary of the Ten Steps Toward Improving Sepsis Quality of Care and Outcomes in Low-Resource Settings, Actions, and Implementation Strategies

Domain	Step	Summary Concepts
Prepare	Governance, health commodities and products	Ensure reliable access to essential sepsis care commodities, infrastructure, and functional equipment through strategic procurement, inventory management, and sustainable financing at system and facility levels.
	Educate and train all providers and caregivers	Implement continuous, competency-based sepsis education for healthcare providers and communities, using blended learning approaches, skill assessments, and awareness campaigns to promote early recognition and management.
Prevent	Prevent sepsis in the community and in facilities	Promote public health interventions, infection prevention, vaccination, hygiene, and awareness to reduce community- and facility-acquired sepsis.
		Leverage surveillance systems to detect and respond to infection risks.
Perform	Recognize and respond	Train providers and caregivers to identify sepsis danger signs and activate emergency response pathways.
		Establish triage, referral, and transport systems supported by decision tools and clear escalation protocols.
	Guideline-based time-critical interventions	Implement context-adapted sepsis bundles and protocols to ensure timely delivery of antibiotics, fluids, oxygen, and source control.
		Use cognitive aids, decision-support systems, and telemedicine to enhance adherence.
	Post-sepsis care	Develop structured post-sepsis care plans including risk stratification, follow-up, rehabilitation, and community-based support to address long-term sequelae and prevent recurrence.
		Leverage remote monitoring when feasible.
Improve	Collect data to measure and improve	Establish sepsis registries and data systems to track key metrics, processes, and outcomes.
		Use standardized data collection tools, integrate with existing systems, and provide actionable care improvement feedback.
	Continuous quality improvement and accountability	Conduct regular audits, track performance indicators, and foster a culture of continuous improvement through interdisciplinary quality improvement initiatives, feedback loops, collaborative networks, and real-time dashboards.
Principles	Culture of excellence, respect and empowerment	Promote teamwork, patient-centered care, cultural competence, and psychological safety.
		Support leadership, mentorship, and respectful communication to foster excellence across sepsis care.
	Patient, caregiver, and healthcare provider well-being	Support the holistic well-being of patients, caregivers, and providers through mental health services, structured communication, support groups, and resilience programs.
		Utilize telehealth to extend care and counseling.

minimize shortages, and improve efficiency. Authorities should be vigilant to uphold standards, reinforce accountability, and ensure sustainable access to life-saving interventions throughout the health system while facilitating the collection and analysis of data. At the bedside, preparedness requires equipment availability, proper storage and maintenance, and quality-assurance measures, supported by training and collaboration between providers, engineers, and biomedical technicians (14, 16–19). These actions strengthen readiness and ensure patients receive time-critical, potentially life-saving interventions without delay.

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Implementation Strategies

- Include essential sepsis care commodities and products in the national essential medicine list and procurement plans.
- Leverage tax waivers and other economic incentives to mitigate supply costs.
- Develop a feasible, longitudinal budget at the national and local levels that includes infrastructure, personnel, and equipment to deliver high-quality sepsis care.
- Directly access supply chains and contracts with local manufacturers/distributors to ensure the availability of sepsis care equipment.
- Use supply chain and inventory management software or mobile apps to track supply levels.
- Ensure the infrastructure and capacity to maintain and store equipment.
- Implement job aids for equipment use, maintenance, and storage.
- Establish quality-assurance procedures with regular assessments to ensure equipment functionality.

PREPARE

Step—Educate and Train All Providers and Caregivers

Action: Implement comprehensive training programs for healthcare providers, caregivers, and families to ensure sepsis prevention, early recognition, and management.

Rationale: Comprehensive education for providers across the continuum of care (e.g., village, health workers, community health workers, first responders, traditional healers, midwives, nurses, clinicians, etc.) is paramount to effectively reduce sepsis-related mortality and morbidity (20–23). This involves not only training the providers on clinical skills but also increasing awareness at the caregiver and community level to empower early identification and intervention. For healthcare providers, sepsis competencies should be embedded into core curricula and reinforced through blended learning (e.g., virtual and face-to-face) and skills-based approaches that maximize simulation- and team-based training (24). Ongoing refresher methods, such as low-dose high-frequency training, just-in-time coaching, and peer feedback, maintain skills over time. Train-the-trainer models and community awareness campaigns expand the reach of education, equipping healthcare providers, caregivers, patients, and families with the knowledge to recognize and respond to sepsis "danger signs" promptly (25). These approaches, including a focus on "danger signs" that reflect infection-related organ dysfunction and severity of illness rather than a specific definition of sepsis, build a knowledgeable, confident workforce prepared to deliver timely, high-quality sepsis care (25).

Implementation Strategies

- Ensure skills-based training and embed sepsis management competencies into the education and postgraduate training curricula of healthcare professionals.
- Implement blended instruction and multimodal learning approaches tailored to individual and local needs.
- Evaluate skill performance with standardized checklists.
- Maintain skills with continuous low-dose, high-frequency, and just-in-time training.
- Create opportunities for sepsis clinical case discussions.
- Promote skilled personnel retention with a rewards and recognition system.
- Promote community awareness of sepsis prevention, highlighting "danger signs" (25), and encouraging emergency system activation.

PREVENT

Step—Prevent Sepsis in the Community and in Facilities

Action: Promote awareness to prevent community-acquired sepsis using public health interventions. Prevent facility-acquired sepsis with implementation of strong infection prevention and control (IPC) practices.

Rationale: Preventing sepsis depends on robust public-health measures in the community and evidence-based IPC measures in facilities; these reduce infections and, consequently, sepsis incidence. Strategies include vaccination, good nutrition, exclusive breastfeeding, clean water and sanitation, and regular antenatal care, especially for high-risk groups. Sepsis requires timely recognition and treatment to achieve early intervention, source control, and optimal outcomes (1). Awareness campaigns can help communities recognize early symptoms and seek care promptly, while health facilities should reinforce hand hygiene, implement IPC programs, and manage infections early to prevent progression to sepsis. Surveillance systems, including emerging technologies, can support outbreak detection and track antimicrobial resistance.

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Implementation Strategies

- Increase sepsis awareness for both communities and healthcare providers.
- Provide universally accessible preventive care and public health essentials, including the promotion of proper nutrition; clean water supply, sanitation, and hygiene; and vaccinations.
- Promote healthy practices in the community.
- Strengthen IPC practices in healthcare facilities.
- Incorporate data-driven surveillance and response systems.

PERFORM

Step—Recognize and Respond

Action: Develop systems for early recognition of "danger signs" (25) linked to rapid response for initial sepsis interventions in communities and facilities.
Rationale: Early recognition of WHO sepsis "danger signs" (25) and rapid response are essential to reduce mortality (26). Training frontline workers, patients, caregivers, and families to identify WHO-defined sepsis signs and initiate emergency response pathways can ensure timely interventions. The development of inter-facility referral pathways and medical transport systems is necessary for timely access to emergency, critical, and operative care. Facilities should implement standardized triage systems with escalation protocols to ensure timely access to the appropriate care level. Bedside clinical assessment remains critical, supported where feasible by laboratory tests and digital tools such as mobile alerts and decision-support systems (27, 28). These strategies enable earlier detection, appropriate differentiation from other critical conditions, and faster initiation of life-saving care.

Implementation Strategies

- Educate and train patients, caregivers, families, village and community healthcare workers, and clinicians to identify WHO sepsis "danger signs" (25) and initiate emergency response pathways.
- Implement triage systems and develop clear inter-facility referral pathways, supported by medical transport, to ensure timely access to operative and critical care when needed.
- Establish medical transport and emergency response systems, including rural and remote regions.
- Establish standardized protocols and escalation pathways within the facility.
- Implement sepsis identification and decision-support tools, including technology-enhanced tools.

PERFORM

Step—Guideline-Based Time-Critical Interventions

Action: Ensure the timely implementation of an appropriate, contextualized sepsis bundle.
Rationale: Sepsis is a syndrome that requires time-critical intervention; the timely implementation of a sepsis care bundle is essential to improving patient outcomes (29–35). Standardized protocols adapted to local context and epidemiology ensure consistency in care (30, 36) and include monitoring, microbiology/rapid tests, empiric antimicrobial therapy, organ support, and timely source control. Embedding contextualized, guideline-based approaches into routine clinical practice strengthens response systems, reduces unwarranted variability, and improves outcomes, particularly in LRS (30, 36, 37). Facilities should ensure access to sepsis diagnostics and essential medications, as well as ensure that sepsis protocols are available, used, and supported by staff training (20, 30, 38, 39). Simulation, team-based training and telemedicine can provide support for community providers. Clinical algorithms, decision-support tools, checklists, and emerging technologies can help clinicians prioritize and execute interventions quickly and consistently, reducing delays and variability in care (38, 39).

Implementation Strategies

- Ensure the availability and implementation of context-relevant sepsis guidelines and care bundles.
- Ensure interdisciplinary team sepsis training.
- Leverage telemedicine and virtual technology to support community providers.
- Use management algorithms and cognitive aids (physical or mobile app-based) displayed where sepsis care is delivered.
- Deploy and leverage decision-support systems informed by contextualized sepsis guidelines, including the use of emerging technologies, where appropriate.

PERFORM

Step—Post-Sepsis Care

Action: Establish a holistic pathway for post-sepsis care, including monitoring for organ dysfunction, rehabilitation, long-term sequelae prevention and management, and follow-up care to support recovery and prevent recurrence.

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Rationale: Patients recovering from sepsis require structured follow-up to prevent recurrence and manage long-term physical, neurocognitive, and psychoemotional sequelae, which can lead to decreased quality of life if not detected and managed in a timely manner (40). Risk stratification and individualized discharge plans should be established before leaving the facility, with clear communication to patients, caregivers, families, and primary providers. Community- and home-based rehabilitation programs, telemedicine support, and remote monitoring tools can extend care beyond facilities and may be particularly beneficial in settings with primary care provider shortages (27, 41). Educating patients, caregivers, and families about the signs of recurrence and available resources enhances recovery and prevents complications. Coordinated post-sepsis pathways promote sustained recovery and reduce the burden of long-term disability (40).

Implementation Strategies

- Risk-stratify and identify the optimal post-sepsis care plan.
- Develop and communicate a coordinated short- and long-term post-sepsis follow-up plan.
- Educate and support the primary care providers/caregivers in the community to facilitate the transition of care.
- Establish community and home-based rehabilitation and support programs.
- Leverage remote surveillance/monitoring and rescue/response tools when available.

IMPROVE

Step—Collect Data to Measure and Improve

Action: Establish sepsis registries that collect and display actionable data, pertinent across resource-variable settings, throughout the continuum of care and include key performance indicators and outcome metrics, while considering the needs of local, regional, national, and international systems of care.

Rationale: Systematic data collection and analysis are critical to track sepsis outcomes and drive improvement. Sepsis registries should include variables with standardized definitions and capture actionable metrics such as mortality, time to sepsis recognition, time to key interventions (e.g., oxygen, antibiotics, fluid administration, source control), and linkage to follow-up care, as well as variables that contribute to morbidity and mortality, such as disease etiology, severity of illness, and risk factors. Where feasible, integrating sepsis metrics and data capture into existing health information systems, such as electronic health record (EHR) systems and the WHO District Health Information System-2, reduces duplication and documentation burden. Routine feedback to clinicians and facilities on key indicators via dashboards can enable the identification of gaps, inform training needs, identify systems issues that require higher-level support, track outcomes in response to improvements and system-level changes, and promote accountability. Leveraging EHRs, mobile data tools, and emerging technologies can streamline data collection, improve accuracy, and ensure that data are actionable to support decision-making at all levels (27, 42, 43).

Implementation Strategies

- Establish sepsis registries to track critical, actionable metrics.
- Develop and disseminate core data elements for sepsis care and outcomes.
- Generate data-informed estimates of sepsis incidence to better understand and monitor the impact of pre-facility interventions.
- Consider intermittent data collection approaches to reduce the burden of data collection.
- Provide regular feedback to identify gaps, inform training, and drive improvement.
- Implement efficient EHR systems that facilitate data capture.
- Integrate tools to improve data accuracy, support decision-making, and increase reporting, inclusive of emerging technologies, when appropriate.

IMPROVE

Step—Continuous Quality Improvement and Accountability

Action: Establish regular team-based interdisciplinary audits to measure the sepsis process of care and outcomes, identify modifiable factors, and analyze data for decision-making.

Rationale: Continuous quality improvement (QI) efforts to evaluate care processes and outcomes can be implemented utilizing patient data at the individual, unit, facility, health system, regional, and national levels. Facilities should provide interdisciplinary QI team training, establish QI committees, conduct regular audits, and implement team-based reviews using structured

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approaches, such as the Scan-Teach-Treat program and Plan-Do-Study-Act cycles (44, 45). QI efforts can be viewed as an iterative process, with facilitators, barriers, success, and failure stories identified and shared with attention to maintain patient confidentiality. Real-time dashboards and feedback loops track performance on key indicators (e.g., time to antibiotics) and identify bottlenecks while recognition systems foster accountability and motivation among staff. Collaborative networks and innovation in implementation research further refine best practices and strengthen a culture of continuous improvement in sepsis care.

Implementation Strategies

- Track key performance metrics in real-time and provide actionable feedback.
- Use dashboards to display performance metrics.
- Conduct regular audits of sepsis care quality to track progress and drive continuous improvement.
- Establish local QI committees and encourage locally relevant project development.
- Incorporate interdisciplinary QI team training (e.g., link learning management with performance and outcome systems to create a learning healthcare system).
- Perform sepsis case reviews to identify opportunities for improvement and potential bottlenecks to care.
- Highlight the high performance and best practices of individuals and teams.
- Develop collaborative QI networks and communities of practice.
- Refine best practices and improve equipment through innovation and implementation research.
- Link data to vital outcomes and disease surveillance systems.

PRINCIPLE

Step—Culture of Excellence, Respect, and Empowerment

Action: Foster a culture of excellence, respect, and empowerment for healthcare teams, patients, caregivers, and families, ensuring optimal sepsis management through clear communication, teamwork, and patient-centered care.
Rationale: A culture of excellence requires respectful communication, teamwork, collaboration, and shared decision-making. Patient- and family-centered care ensures alignment with cultural values and goals. Leadership should foster mentorship, professional development, and accountability to sustain high standards. Digital platforms can support communication and documentation. Embedding excellence and respect into daily practice enables effective, patient-centered sepsis care.

Implementation Strategies

- Promote culturally sensitive, transparent communication and shared decision-making.
- Respect all cultural, religious, and spiritual backgrounds.
- Support continuous professional development and leadership.
- Promote mentorship and role modeling.
- Engage and respect multidisciplinary teams.
- Provide cultural competence training for providers.
- Use digital platforms for coordinated communication and documentation.

PRINCIPLE

Step—Patient, Caregiver, and Healthcare Provider Well-being

Action: Support patients, caregivers, families, and healthcare providers during and after sepsis care.
Rationale: Promoting well-being for patients, caregivers, families, and providers strengthens recovery and preserves a resilient workforce. Comprehensive support (e.g., counseling, support groups, bereavement care, spiritual services) reduces post-sepsis complications. Telemedicine and remote tools improve access. Workforce well-being depends on adequate staffing, fair compensation, mentorship, and psychologic support to prevent burnout. Prioritizing holistic well-being ensures stronger recovery for patients and a sustainable healthcare workforce.

Implementation Strategies

- Identify the needs and concerns of the caregiver and patient, and engage spiritual, psychological, and religious officials to support well-being.
- Ensure patient, caregiver, and family access to support groups and bereavement counseling.
- Form patient advisory councils and use the council's feedback to improve the patient, caregiver, and family experience.
- Use language interpreters when appropriate.
- Ensure that providers have access to psychologic support.
- Foster healthcare worker well-being.

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- Collect anonymized feedback from patients, caregivers, families, staff, and providers, and use it to inform positive change.
- Implement telemedicine platforms for follow-up care and counseling.

CONCLUSIONS

The ten steps to Improve Sepsis Care and Outcomes, inclusive of LRS, is a pragmatic approach for key stakeholders, including healthcare leaders, health ministries, and healthcare facility administrators to identify current strengths and existing gaps in sepsis care. These steps, actions, and implementation strategies were identified as part of a multidisciplinary team consensus of global experts from diverse settings and are intended to strengthen the Sepsis Chain and Frame of Survival (3), improve the quality of sepsis care, and decrease morbidity and mortality due to sepsis, particularly in LRS. Health disparities persist on a global scale, however, and there remain significant knowledge gaps in sepsis management, especially in LRS; more research is needed, as well as dedicated resources for education and global awareness. Additionally, it is crucial to work at the policy level in coordination with the WHO, ACAN, national ministries of health, and other global and local organizations, while supporting Universal Health Coverage efforts and country-specific strategic plans, to ensure that these efforts are sustainable, appropriately prioritized, and contextually relevant. In conclusion, the ten steps are a feasible, innovative approach to improve the quality of sepsis care, sepsis-related outcomes, and global disparities.

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1 *Department of Pediatrics, Critical Care Medicine, University of California San Francisco, San Francisco, CA.*

2 *Institute for Global Health Sciences, University of California San Francisco, San Francisco, CA.*

3 *Division of Critical Care and COVID-19-Unit, Belize Healthcare Partners Limited, Belize.*

4 *Kenya Medical Research Institute-Wellcome Trust Research Program (KWTRP), Nairobi, Kenya.*

5 *Department of Anesthesiology, Critical Care and Pain, Tata Memorial Hospital, Homi Bhabha National Institute, Mumbai, India.*

6 *Sections of Infectious Diseases and Critical Care Medicine, Wake Forest University School of Medicine, Winston-Salem, NC.*

7 *Critical Care Services, Baptist Hospital of Miami, Miami, FL.*

8 *Maharajgunj Medical Campus at Institute of Medicine, Tribhuvan University Teaching Hospital, Tribhuvan University, Kathmandu, Nepal.*

9 *Department of Surgery and Emory Critical Care Center, Emory School of Medicine, Atlanta, GA.*

10 *Department of Clinical Sciences, Liverpool School of Tropical Medicine, Liverpool, United Kingdom.*

11 *Walimu, Kampala, Uganda.*

12 *Department of Pediatrics, Faculty of Medicine, University of São Paulo (FMUSP), São Paulo, Brazil.*

13 *Department of Pediatrics, British Columbia Children's Hospital, Vancouver, BC, Canada.*

14 *Intensive Care Department, Hospital Universitário/Hospital São Paulo, Escola Paulista de Medcina, Federal University of São Paolo, São Paulo, Brazil.*

15 *Kamuzu University of Health Sciences, Blantyre, Malawi.*

16 *Department of Pediatrics and Child Health, University of Cape Town, Cape Town, South Africa.*

17 *Division of Critical Care, State General Hospital, Hermosillo, Sonora, Mexico.*

18 *Division of Critical Care, Department of Medicine, Siriraj Hospital, Mahidol University, Bangkok, Thailand.*

19 *Division of Pulmonary and Critical Care Medicine, Phramongkutklao Hospital, Bangkok, Thailand.*

20 *Adult Critical Care, St George's University Hospitals NHS Foundation Trust & City St George's, University of London, London, United Kingdom.*

21 *Muhimbili Orthopaedic Institute, Dar es Salaam, Tanzania.*

22 *Department of Research and Quality, Society of Critical Care Medicine, Mount Prospect, IL.*

23 *Department of Anesthesiology, Critical Care and Pediatrics, University of Pennsylvania Perelman School of Medicine, Philadelphia, PA.*

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For information regarding this article, E-mail: teresa.kortz@ucsf.edu

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